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ON-BOARD POWER AND BATTERY SYSTEM FOR SMALL SATELLITES

Abstract

Advances in contemporary space mission design allow for the development of more and more miniaturized spacecrafts with a short development time. Most of the attention in the previous years was focused on small satellites around 1-5 kg, while now many missions are shifting towards 10-50 kg satellites. To support the two markets, ISIS - Innovative Solutions In Space B.V. and SystematIC design B.V. jointly started the development of a versatile and scalable power system. Since Electronic Power Systems are crucial in satellites and are reported as one of the main causes for failure in several small satellite missions, reliability has always been the most important goal of the design.

This paper presents the newly designed EPS and it will focus on the testing and qualification methodologies applied to achieve reliable power storage by means of commercial Lithium-Ion batteries. Battery technology was carefully evaluated to achieve the previously mentioned performances and characterization procedures and results have been elaborated according to ECSS standards. Extensive characterization is being performed to achieve confidence on the battery lifetime estimation. Suitable thermal design has been also carried out to ensure safe operation of batteries at optimal temperature. The main advantage of the newly developed system is its flexibility and scalability, which can be achieved also thanks to commercial batteries.

The EPS has been developed with COTS components leading to cost effective mass production. Yet the system is qualified for space flight in LEO. Particular attention was paid to avoid Single Point Failures and to have a redundant system capable of tolerating faults. To properly address such a wide market a scalable design was selected, allowing fitting the system for 2U CubeSats with only body mounted cells up to 12U CubeSats with deployable panels. If a higher redundancy level is required, the power system can be connected in a hot / cold redundant setup. This solution also allows further widening the application range to 20 – 50 kg satellites.

The development of this new line of products takes advantage of the synergy between the partners, with different backgrounds but all focused to improve the performance of current space systems to fit highly demanding small satellite missions.